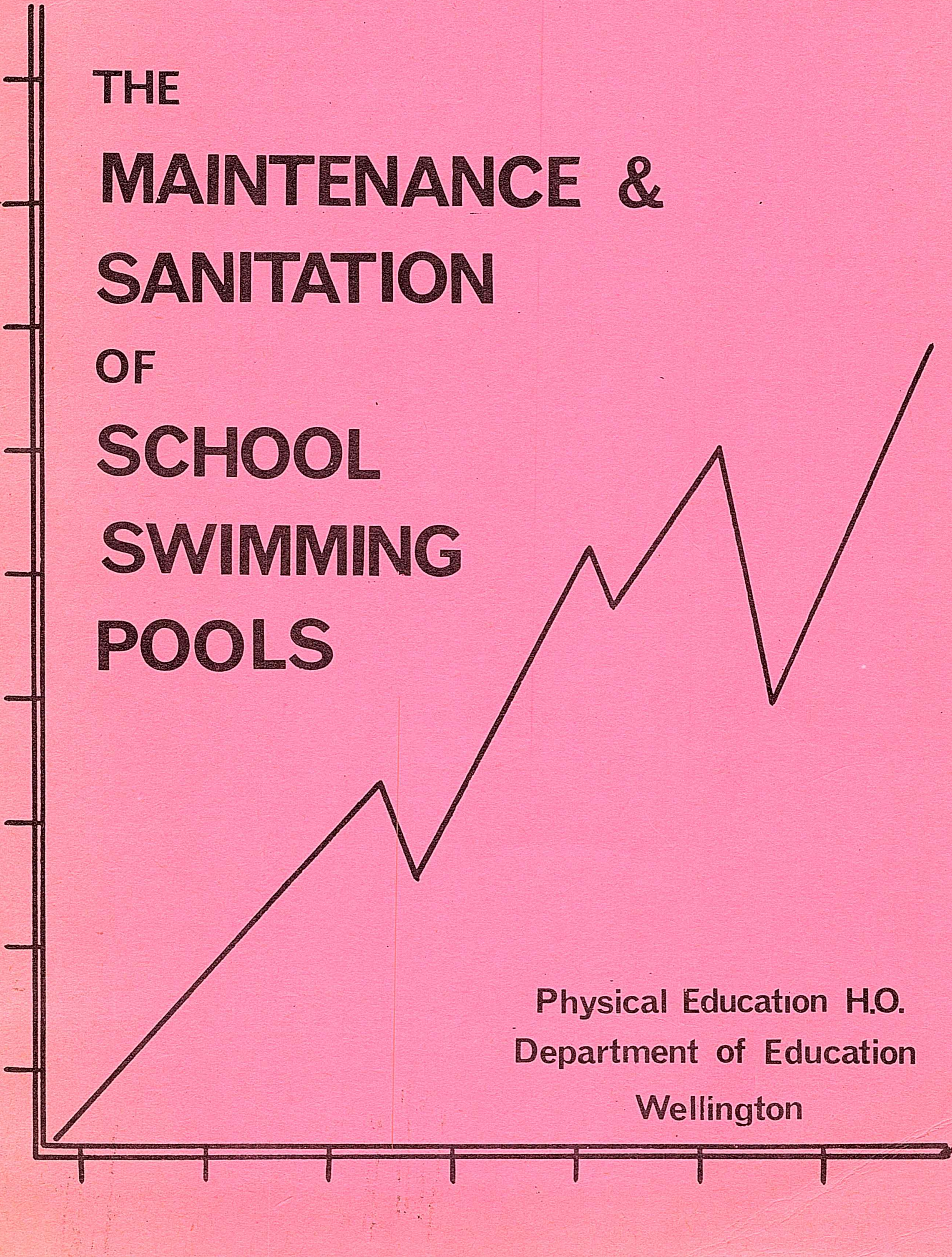
F. Wilson

THE MAINTENANCE & SANITATION OF SCHOOL SWIMMING POOLS



Physical Education H.O.
Department of Education
Wellington

1.00

The following are useful facts, which are explained in detail in the text of this pamphlet.

Chlorine residual should be 1.0 p.p.m. (75% of which is F.A.C.)
first thing in the morning.

pH should not be below 7.6.

Filter and chlorinator must run twenty-four hours per day
throughout the season.

For complaints of odour or eye irritation:

(1) Increase pH to 9.0.

(2) Increase chlorine dose.

1 oz. of high test calcium hypochlorite per thousand gallons gives
4.4 p.p.m. F.A.C.

3 lb. cyanuric acid per 10,000 gallons gives 30 p.p.m. cyanuric acid.

1 gallon of water weighs 10 lb.

1 cubic foot of water = 6.25 gallons = 62.5 lb.

Never introduce copper sulphate to the pool.

NEVER ALLOW CHILDREN TO HANDLE CALCIUM HYPOCHLORITE POWDER OR SOLUTION

THE MAINTENANCE AND SANITATION OF SWIMMING POOLS

The aim of this publication is to provide school swimming pool operators with sufficient basic information to enable them to operate school pool water treatment plants with reasonable understanding.

Instructions given here are complementary to those provided by the equipment manufacturers who supply specific information for their products.

We are indebted to the Chief Public Health Engineer of the Ministry of Works for much of the material included in this revision.

Dudley R Wills

D. R. WILLS

National Adviser on Physical Education

Swimming is a national pastime in New Zealand. Our long coastline, suitable beaches and moderate climate make "bathing" one of our most popular recreations. There is, in fact, considerable interest in all forms of aquatics: swimming, surf-riding, surf-lifesaving, rowing, sailing, underwater fishing, water-skiing and other water sports. Many thousands of New Zealanders spend some part of every year in or on deep water and the numbers are increasing. In these circumstances the ability to swim is a basic skill needed by everyone for the pleasure it can afford as an inexpensive recreation, for the healthy exercise it offers and for the margin of safety it can provide in a number of popular sports.

The importance of the ability to swim well has long been recognized by the Department of Education. The teaching of swimming and water safety skills is part of the physical education programme in schools and teachers' colleges. The 'learner' pool developed in 1940 for primary schools, and larger pools for secondary schools are subsidized $ for $ with certain limits set by the Department. At present there are over 1,500 pools in our schools, 70% of which are filtered. It is not surprising then that over 90% of the teaching of swimming and lifesaving in New Zealand is done by school teachers.

The 'learner' pool has proved to be the most successful medium in which to teach swimming. It is shallow, warms quickly, the hand rail is never very far away from the nervous beginner and the teacher is quite close to the children, thus making teaching so much easier. Freed from the constant anxiety of deeper water, the teacher is able to concentrate on swimming instruction.

Need for Water Treatment

Water in a swimming pool becomes contaminated by body discharges, dirt carried on bathers' feet and bodies, hair and lint from costumes and wind-blown leaves and dirt. If the water is left unchanged and untreated, bacteria and other organisms - some injurious to health - will collect and multiply at a tremendous rate. The greatest concentration of these organisms is on the surface where mucous and grease accumulate. Heavier material, such as leaves and dirt and hair, sinks to the bottom to form a breeding ground for algae growths and unsightly slimes which by their slippery nature become an accident hazard.

Two systems are used to eliminate these accumulations from the pool:

(a) Continuous recirculation of the water through a filter.

(b) Total emptying and refilling with clean water at frequent intervals (fill and draw).

Whatever system is used, it is necessary to destroy any organisms that are introduced to the water by swimmers, or from atmospheric sources, by introducing a disinfecting agent - usually chlorine - to the water.

Functions of the Recirculation System

The functions of the continuous recirculation system are:

(a) The continuous withdrawal of dirty water from the pool at a sufficient rate to prevent the build-up in contaminents.

(b) The removal by the lint strainer of coarse dirt such as hair, lint, leaves and grit which cause interference with subsequent treatment processes.

(c) The recirculation by means of pumping of the water through the treatment plant and back to the pool.

(d) Filtration to remove finer suspended dirt.

(e) The addition of chlorine as an active and residual disinfectant.

(f) Provision for the washing of filters of accumulated dirt.

The advantages of continuous filtration over the fill and draw system include true clarity of water by removal of all organic and inorganic material, effective disinfection by maintaining a constant dose rate of chlorine resulting in a residual of unused disinfectant in the pool at all times, and saving of considerable volume of water.

Pool Management

With any kind of swimming pool it is essential that the pool and surroundings be kept safe and sanitary. The health of those who use the pool must be safeguarded. The first requirement for this purpose is a good, clean, water supply equal to drinking standards. This standard is laid down by the Department of Health and schools must see to it that such a supply is available and tested before proceeding to build a pool. When a pool has been filled from such a supply, the water must be kept safe by appropriate treatment. This treatment is dealt with fully in this pamphlet.

While safe, hygienic water is a pre-requisite, careful management and maintenance of the pool and surroundings is essential. The following suggestions should help maintain adequate standards:

1. The swimming load should be kept within the capacity of the facilities.

   This applies to the pool itself and to the changing and toilet accommodation. When a pool is being built, the likely growth of the school population and the increasing swimming load should be kept in mind.

   The teaching of swimming is much more effective with small numbers than with large. Therefore, keep the number of swimmers at any one time to a practical minimum. In a filtered pool the number of bathers per hour should not exceed one per 320 gallons of pool capacity. (In fill and draw pools one child per 500 gallons at a time.) If pools are loaded above this number, the difficulties of maintaining water purity are greatly increased.

2. Exclude all children having obvious or known infectious conditions, particularly those with poor nasal drainage, discharging ears, those suffering or just recovering from a common cold and those with skin infections of any kind.

   Encourage thorough bather cleansing in changing rooms by the use of toilets, showers, and wash-hand basins, etc. Footbaths help prevent dirt from being carried into pool (footbaths should be located at the shallow end of the pool and should have provision for frequent changing of water).

3. Dressing shed accommodation should be large enough for the school, have a concrete floor, sufficient coat pegs, a shelf or seat on which shoes and socks can be placed, have screened entrances and be adequately ventilated. Many schools prefer to have no roof so that maximum ventilation and drying is possible. Others compromise with a narrow internal lean-to shelter over clothes and the centre of the shed open to the sun. This is a very satisfactory arrangement. Ventilation

at floor level helps to keep floors dry.

Wooden duckboards and matting should be eliminated as these are a gathering place for bacteria and fungi brought in on shoes.

Dressing shed floors should be cleaned and disinfected daily. After initial cleaning with broom and hose, floors should be mopped with either a strong chlorine solution or a germicide.

4. Pool surroundings should be kept scrupulously clean. Dust and leaves contaminate water. Adequate fences, clean concrete paths and surrounds, and trim grass borders help to keep dirt out of the water. Close daily attention should be given to the surroundings of the pool.

5. Where showers are installed, they should be sited in such a way that the shower water does not dilute the chlorine in the footbaths.

6. Swimming costumes should be washed frequently - never in the pool itself - and a clothes line for drying wet costumes should be provided.

7. No dogs or other animals should be permitted in or near the pool.

8. Non-bathers should not be allowed in the pool enclosure.

9. The orderly arrangement of classes for lessons needs no comment here. Suggestions about this are made in the pamphlet 'Swimming' issued by the Department of Education. But well organised lessons and changing arrangements can contribute to a tidy installation, clean water and sanitary surroundings as well as to competent swimming.

Water Standards

Good swimming pool water is up to drinking standards bacteriologically, that is, its content of disease organisms is so small that there is no chance of infection arising. It has no unpleasant odour or taste from its chemical composition, is free of suspended matter and has a blue, clear, sparkling appearance. Clear water is of the utmost importance in pools especially where there is a deep end. Drownings have occurred in turbid pool water simply because the victim could not be seen. Clear water is easier to keep safe because it contains much less solid colloidal matter which absorbs sterilizing chemicals.

The majority of our learner pools are now filtered. However, there are still many of the "fill and draw" type. These pools need careful supervision and very frequent water testing and adjustment if the water is to be kept safe for swimming purposes.

Disinfection of Water

To be kept fit for swimming purposes, water has to be chemically disinfected. To do this properly, it is not necessary to be a chemist, but some understanding of the needs and of the chemical processes involved is required.

The main purpose of disinfection of the water is to kill any disease causing organisms which may be introduced into the pool by infected bathers.

Chlorine

Chlorine, in one of its various forms, is used as an active bactericide and can also be maintained throughout the water of the pool as a residual disinfectant available for immediate attack on organisms from the moment they are introduced into the pool.

Chlorine is obtainable in the following forms:

(a) Pure chlorine, liquefied under pressure and delivered in steel pressure cylinders.

(b) Chloride of lime, which contains about 33% available chlorine.

(c) Sodium hypochlorite, containing about 12% available chlorine.

(d) High test calcium hypochlorite containing about 70% available chlorine.

The hypochlorites are available as a powder or in granular form and must be dissolved in water before use in the pool.

Because pure chlorine as a gas may be hazardous if not properly controlled, it is usual to use the safer chlorine compounds in pools not under the control of a trained operator. The high test calcium hypochlorite is generally used in our schools.

Free Residual Chlorination

Swimming pool waters contain ammonia and organic compounds introduced continuously by bathers. This material is not to be confused with the disease-causing bacteria and viruses mentioned above, however, the nitrogenous and organic matter in the pool combines with some or all of the chlorine present to form compounds of chlorine and nitrogen called chloramines, and the residual is called the "combined chlorine residual". Chloramines may exist in a number of varying forms all of which are themselves bactericidal, but very slow in their killing effect. In addition, certain forms of chloramine may be the cause of irritation to eyes and mucous membranes as well as causing unpleasant chlorinous odours.

When sufficient chlorine is added, it not only combines with the interference substances, but actually breaks them down by chemical action until an excess of uncombined chlorine is available. This excess is in the "free available" form and the residual is the "free chlorine residual". Free chlorine in solution, provided that other factors are favourable, is a very powerful and active bactericide capable of quickly killing most bacteria. This is the aim in swimming pool disinfection.

Further advantages accrue with free residual chlorination and these are all summarised as:

(a) As stated, a more rapid disinfectant action and ability to hold an effective reserve disinfection to combat increased contamination.

(b) Improved clarity and appearance of the water.

(c) Increased bather comfort by reducing the irritating chloramine compounds.

(d) Minimises algal growth.

(e) Reduces filter loading and increases filtration efficiency.

In practice it may be found difficult to achieve free residual chlorination during the hottest part of the day with peak bathing load. However, with continuous 24 hour operation of the plant, the nuisance compounds should be chemically reduced overnight and a free residual is then obtained by the morning together with the desired water clarity.

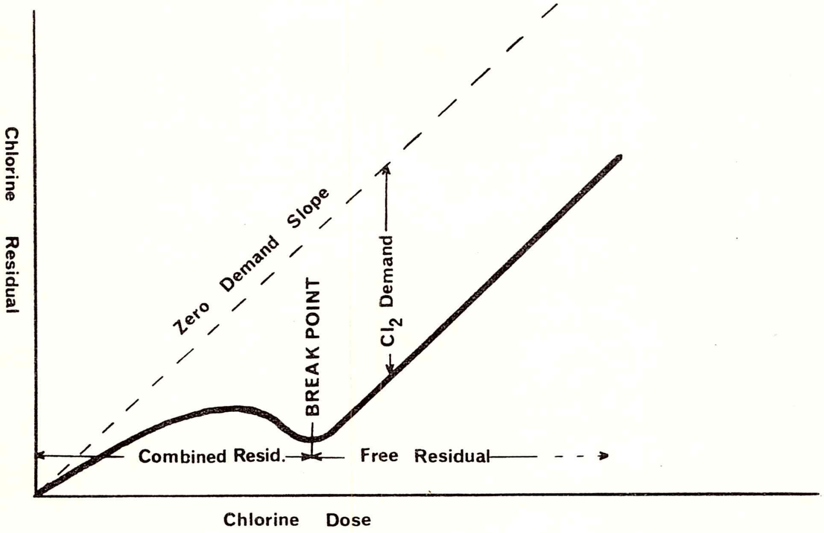
The Application of Chlorine

Chlorination equipment continuously feeds chlorine solution to the recirculated pool water at a controlled, but adjustable rate. The equipment itself may be either a gas chlorinator, which meters the pure gas under vacuum, dissolves the gas in a small flow of feed water and injects the solution, or a hypochlorinator which feeds a prepared solution of chlorine compound.

Chlorinators differ in detail depending on basic type and make and operational method cannot be conveniently generalised in a general publication.

Pool operators must ensure that chlorine gas or solution supplies are replenished as required.

Quite frequently, with water containing many impurities, considerable quantities of chlorine have to be added before any free residual remains. This is the "Chlorine Demand" of the water. Once the Chlorine Demand has been satisfied, all additional chlorine added results in a proportionate increase of free residual. The point where the Chlorine Demand is satisfied is known as the Break Point and is illustrated in the graph below:



Chlorination Procedure

After the initial Chlorine Demand has been satisfied, heavily loaded school learner pools should be treated 24 hours a day. This allows the chlorine to react with and break down organic matter and objectionable compounds which have very likely built up in concentration during the day. Stepping up the chlorine dose early in the morning before swimmers enter the pool allows a higher free residual of chlorine to be obtained, increases the ratio of free residual to combined residual and gives an operating margin to minimise complete loss of free residual as the organic contaminants increase after bathers enter the water. In open air pools there will always be a chlorine loss to atmosphere under the action of sunlight which will further depress the free residual.

An early morning free residual of from 1.0 to 2.0 p.p.m. may need to be achieved to enable the chlorine demand to be met during the day and still maintain at least a trace of free residual.

As the free residual decreases throughout the day, the combined chlorine residual will increase and hence the wisdom of all night chlorination to break down the degradable chlorine-nitrogen compounds in time for the start of the next day's swimming.

Efficient chlorination really requires regular daily adjustment of the chlorine dose rate to meet the variations in chlorine demand throughout the day. This, in turn, requires several tests daily of the free residual obtaining in the pool from time to time and this method of control is recommended. Amateur pool operators will soon become skilled in quickly testing for chlorine residual and making appropriate adjustments of dose rate at the chlorinator.

To satisfy the initial Chlorine Demand may require up to one third of the whole season's supply of calcium hypochlorite. Many water supplies contain iron in solution. Even small traces of iron require considerable amounts of chlorine to be oxidised.

If possible, obtain a detailed analysis of your water supply and for each 1.0 part per million of iron, manganese and ammoniacal nitrogen add 10 p.p.m. of chlorine. This will give you a minimal figure which is some guide to the Chlorine Demand of your supply.

With fill and draw pools, the chlorine demand must be met each time the pool is refilled. This, in some areas with poor water, can be a very costly business and schools are strongly urged to install filter plants. The instructions below will serve as a starting point on which to base your own procedures, asno one set of instructions would satisfy all situations.

(a) Initial treatment. This should be done on Sunday evening to allow the pool to be ready for use on Monday morning. For each 1,000 gallons of water in the pool, mix 2½ oz of 70% calcium hypochlorite with water in a bucket. If a compound containing less than 70% chlorine is used, then increase quantity proportionately. (The maximum solubility, i.e. a saturated solution of most hypochlorites, is about 2 lb. per 10 gal. water.) Walk round pool distributing this solution as widely as possible. Do not pour residue from the bucket into the pool. Add water to the bucket and repeat until all is dissolved. Stir the pool water by dragging a bucket back and forth from end to end. DO NOT PUT CHILDREN IN THE POOL TO MIX THE CHLORINE SOLUTION THROUGHOUT THE WATER.

(b) On Monday morning at 8 a.m. observe the appearance of the water and take a test.

1. If the test gives a reading of between 0.5 and 0.8 p.p.m., the pool will be ready for use.

2. If there is no reading, but the water appears crystal clear and sparkling, the addition of approximately one quarter oz. of 70% calcium hypochlorite per 1,000 gallons should raise the level of free chlorine to that required. Allow at least one hour between the addition of the solution and the check test.

3. If no reading shows on test, and if the water does not appear any different from the initial fill, it will mean that 2½ oz. per 1,000 gallons is insufficient to satisfy the initial chlorine demand. In some circumstances a further heavy dose of 2½ oz. per 1,000 gallons may be needed, but usually 1 oz. per 1,000 gallons will suffice. After this dose, leave the water for two hours, then check test and add more chlorine if necessary.

4. Chlorine should be added continually throughout the day (probably about 12-16 p.p.m. per day - or 304 oz. of 70% calcium hypochlorite per 1,000 gal. per day). This is best done by placing the day's supply of hypochlorite in a drum with a quantity of water and allowing it to settle, and adding all the resulting solution into the pool throughout the day, a little at a time.

Tests should be carried out regularly and recorded. From the results, the most economical quantities to use can be worked out.

Making up a Hypochlorite Solution

Sufficient hypochlorite solution should be made for 24 hours continuous dosing. Add a measured quantity of hypochlorite powder to a sufficient amount of water in a plastic bucket to mix into a thin paste. Add more water, stir and let stand in the bucket for 10 to 15 minutes. A white sediment will settle to the bottom. Decant the clear liquor into the chlorinator solution tank and make up the volume with water to give the dosing strength required. Discard the sediment. Cover the solution tank with a lid.

Solution strength is often 1% which is one pound weight of available chlorine to 100 pounds weight of water. As one gallon of water weight 10 lbs, a 1% solution would have one pound of chlorine to every 10 gallons of water. 1 lb 7 oz of 70% high test hypochlorite contains the equivalent of 1 lb of available chlorine.
Solution strengths may be varied with experience to suit the dose rate and weaker solutions are commonly adopted. Do not stir the solution once it has been made up. If the suction hose to the chlorinator is not fitted with a fine strainer in the solution tank, it is advisable to use either a wooden float or a stand to keep the inlet of the hose above the bottom of the tank to avoid drawing in any residual sediment.

Take particular care not to splash concentrated chlorine solution into the face or eyes. The use of safety goggles is recommended. Remember that the solution is corrosive to metal and rubber.

Control of pH

The water in the pool must be kept in a condition comfortable to swimmers, such that irritation to eyes and mucous membranes is avoided and such that unpleasant odours from chlorine compounds are not produced. To achieve the correct condition and to improve treatment effectiveness, the chlorine residual and pH must be in balance.

The pH value is obtained by simple test and is a measure of the degree of alkalinity but not of the amount of alkalinity. A neutral pH of 7.0 indicates that alkalinity is just in balance with acidity. Values of pH greater than 7.0 indicate an alkaline water and all swimming pool waters must be maintained in alkaline condition.

In our learner pools where calcium hypochlorination is practised we recommend that the minimum pH level be 7.6. The level should never fall below this, as it is at the lower pH values that some of the chloramines that cause the typical chlorine odours and sore eyes are formed.

It is desirable to measure the total alkalinity of the pool. This is a measure of the quantity of alkaline material present in the pool and is expressed in p.p.m. This reserve alkalinity acts as a buffer by neutralizing any acids that are introduced to the pool. When using calcium hypochlorite alkalinity is constantly added to the pool automatically. However, the level should be brought up to 100 p.p.m. at the start of the season.

As the test for alkalinity is quite complex, assistance should be sought from your local Adviser of Physical Education.

Alkalinity can be increased by the addition of soda ash, or sodium bicarbonate. Sodium bicarbonate has advantages as, even if an excess is used the pH will not exceed 8.3 and there is no risk of precipitation due to hardness salts forming in the water. pH can be reduced by using sodium bisulphate.

Pool Water Tests

Tests for chlorine residual and pH of the pool water should be made several times a day.

Samples of water for the test should be taken from a depth about one foot below the surface. Surface water chlorine results may be misleading because of dissipation of the chlorine by sunlight.

Colour Comparator Test Kit

The comparator is a device which permits easy, visual comparison of a coloured water sample with a set of standard coloured glass discs in such a way that reasonably close estimates of the pH and chlorine residual can be obtained quickly even by unskilled persons.

The device can be fitted with any one of a range of standard colour discs, each with its particular colour indicator solution, to measure a wide range of pH values and chlorine residuals.

Although the comparator is a simple device, instruction in its use is really a matter for practical demonstration and this should be sought from the physical education adviser in your area.

Algae Control

If pool water begins to turn green or if green and brown spots appear on the sides of the pool, the usual cause is the growth of algae. Algae are minute plants which draw energy from sunlight and the nutrients which exist in the swimming pool water. The spores of algae are carried in the air and a pool may contain many varieties. Clinging algae in particular, besides being unsightly, can be slippery underfoot, thus being an accident hazard. Algae growths may harbour bacteria as well as creating a high demand for chlorine.

Algae growths are prevented or, when established, controlled in the following ways:

(a) The maintenance of a free chlorine residual at all times will inhibit the onset and growth of algae. This obviously requires 24 hours a day running of the plant.

(b) The application of a proprietary algicide to the pool water to kill algae spores.

(c) By emptying the pool and scrubbing surfaces with a strong hypochlorite solution. Add about 5 lb of high test calcium hypochlorite to 10 gallons of water to obtain a concentrated solution.

(d) By maintaining a smooth interior pool surface, free of cracks, paint blisters and so forth which give a trip for the algae.

Under no circumstances should copper sulphate (bluestone) be added to pool waters. Although this is an algicide, it also rapidly corrodes any metal fittings in the pool, as well as the inside of the filter plant and pumps. Its effectiveness is also reduced by 50% when used with diatomaceous earth filters.

The Hair and Lint Strainer

This strainer usually consists of a non-corrosive metal basket screen which is easily removed after releasing finger nuts and lifting off the cover. The hair and lint strainer is to remove hair, lint, leaves, twigs, paper and similar coarse or stringy matter which could cause blockage of the pump or the filter. Although such material would be entrapped on the filter, it is often difficult to remove it during the backwash.

It is important that the hair and lint strainer be cleaned out regularly to prevent loss of pump efficiency. If a spare basket is provided, this should be re-set and the dirty basket flushed clean and, if necessary, wire brushed.

The screenings are often more easily removed from the basket when dried.

Pumps and Motors

Pumps and motors must be kept dry and clear of chemicals. Apart from regular lubrication in accordance with the makers' recommendations, the maintenance of these units isoutside the scope of the amateur.

Filters

Most pools have pressure type sand filters installed but open tank vacuum type diatomaceous earth filters are also used.

Filters (together with the rest of the treatment equipment) should be operated 24 hours a day throughout the swimming season if a clear pool water is to be maintained.

The quality and grading of the sand media in filters is very important. Never attempt to re-charge or to top-up a filter with any sand other than that supplied by the filter manufacturer.

As a filter accumulates a dirt load in operation it will not only exert an increasing resistance to flow, but also will lose filtering efficiency. Filters are supplied with pressure gauges which may measure the actual filter inlet and outlet pressures or may indicate the differential pressure between these two points. With increasing flow resistance through the filter this pressure difference will likewise increase. When the pressure difference is sufficiently great to impede efficiency, the filter must be washed as next described.

Filter valving will vary in detail between different makes of plant. Some filters are fitted with multiport valves which are simple to use and group all actions of the valving system under one control handle.

Washing Filters

A freshly washed filter will have a pressure differential of about 1 pound per sq. inch on the gauges. When, after a period of filtration, the pressure builds up to about 5 lbs per sq. inch (or any other pressure which the manufacturer recommends) the filter must be backwashed.

Backwash in accordance with the instructions supplied by the manufacturer. Recommended backwashing times will vary with the type of plant installed, but it is important to be sure that the filter sand is thoroughly cleaned with each backwash.

Inspection of Filters

Periodic inspection of the sand media can be valuable in allowing early corrective maintenance if faults have occurred.

A clean sand bed free from dirt and accumulations of hair, leaves or other foreign matter is indicative of an efficient filter provided that no loss of sand has occurred.

If, after backwashing, the surface of the sand is dirty, then it is likely that insufficient backwashing is being applied. This may mean that the pump is not delivering the required backwash flow because of wear or because of blockage in the delivery piping system which returns filtered water to the pool. It is also possible that the backwash is not being applied for a sufficient length of time to completely remove all entrapped material. If longer backwashing periods do not rectify the condition, then a thorough inspection of the pump and the piping system is required.

In very bad cases of filter bed fouling the sand may need to be removed and thoroughly washed before replacement. If sand has been lost, the media must be made up to full depth with the correct type and grading obtained from the filter manufacturer.

Diatomaceous Earth Filters

This filter may be either of the pressure or vacuum type, the latter type being installed on the suction side of the recirculation pump.

Diatomaceous earth and "body feed" (supplied by the filter suppliers) are fed at a controlled rate at the start of the filter run. These additives to the water being filtered coat the porous septa or diaphragms in the filter and it is the coating which acts as the filter medium. When the filter is washed, the coating is also washed to waste. The coating is much denser than sand media and is capable of filtering out much finer material without the need for water conditioning as for sand filters.

On the other hand, the dense coating induces a greater pressure increase in a given filtering time than does sand and this type of filter usually requires more frequent washing. It is desirable to apply the pre-coat at a suitable rate such that only one filter wash per day is required. This enables the plant to be operated without break while the pool is in use during the day.

An important point to keep in mind is that the diatomaceous earth filter media is held on to the supporting elements under nominal pressure only when the recirculation pump is running. Any stoppage of the pump may allow the media to slough off with complete loss of filtering action.

Off-season Protection

Prepare the pool and treatment plant for wintering-over as follows:

(a) Wash filters thoroughly with a weak detergent solution (introduced either directly to the filter or to the balance tank). After washing, flush the filter and drain completely.

(b) Thoroughly clean all chemical feeding equipment, flush out dosing and drain lines and drain completely. Lightly grease corrodible parts.

(c) Disconnect the chlorinator and drain it of water after flushing out all residual solution. Lightly grease metal parts.

(d) Flush out and drain the recirculation pump, grease bearings as necessary and disconnect fuses from the electrical supply.

(e) Clean and drain all other equipment.

(f) Draw down water level in pool to about 6" below scum channel or skimmer weir level. Keep the pool filled at this level. This prevents drying out and cracking of the structure and also safeguards the structure against "floating" or movement resulting from a high winter ground water level.

(g) Dose the partially filled pool with either a strong chlorine solution, or an algicide.

(h) Just prior to the new swimming season the pool may be emptied and scrubbed to remove any surface slime. Alternatively, dose heavily with a chlorine solution and clean surfaces with the suction cleaner.

Swimming pool paint actually stands up better under continuous immersion than for long periods of dryness when the pool is empty. When a pool is empty in the normal periods, care should be taken to clean down all sides and bottom while the pool is still wet. This precaution is essential if the life of the paint coating is to be preserved to its maximum. Pools should be kept partly filled in the off season. Suitable action against algae should be taken in the off season.

Your local controlling authority Buildings and Maintenance Supervisor should be consulted about all painting matters.

Cyanuric Acid

Many schools are using this substance in their swimming pools with a considerable saving in calcium hypochlorite.

Cyanuric acid has the effect of locking the chlorine in solution, preventing its rapid dissipation in sunlight yet liberating sufficient to carry out adequate disinfection of the water.

The powdered cyanuric acid should be added directly to the pool after Break Point has been reached and the initial Chlorine Demand met. Sufficient to make 30 p.p.m. should be added. After this chlorination should continue normally. However, the level should be raised to 1.5 p.p.m. F.A.C. It will probably be found that considerably less (up to 50% less) hypochlorite will be required to maintain this level.

The concentration of cyanuric acid slowly drops and additions have to be made from time to time. As a suitable test for cyanuric acid is difficult to obtain, rule of thumb methods may have to be adopted. Contact your local physical education adviser for guidance.

Keeping Costs Down

Pool management is the key factor here. Some suggestions for keeping costs down are:

1. Keep careful records of pool loads, chlorine doses, tests and pool conditions.

2. Study these to arrive at the best techniques for your water and pool conditions.

3. Keep dirt out of the pool:

    (a) By keeping dressing sheds, filter house and pool surrounds scrupulously clean.

    (b) By insisting on the use of toilets, footbaths and showers before swimmers enter the pool.

4. Keep the bathing loads within reason.

5. Maintain proper chlorine and pH values.

6. Use only the best chemicals and other materials.

7. Discourage skylarking, splashing, free play in the pool.

8. Keep plant running 24 hours a day.

Notes